CLAIMS

1. A substrate for a biochip comprising a flat optical mirror surface, which mirror reflects incident excitation and/or emission photons, and

a transparent dielectric layer coating said surface,

said layer having properties such that, for a set or range of reference wavelengths, the dielectric possesses a thickness such that destructive interference occurs for at least one of the following conditions at the surface of the dielectric opposite the mirror:

i. for incident excitation light energy, destructive interference occurs between radiation propagating toward the mirror through the dielectric and reflected excitation radiation propagating away from the mirror, and
ii. for light energy emitted via spontaneous emission, scattering or other process, destructive interference occurs between wavefronts emitted or scattered toward the direction away from the mirror and wavefronts emitted or scattered toward the mirror and reflected by the mirror.

2. The biochip substrate of claim 1 where the thickness of the dielectric is chosen to be approximately N/2 wavelengths, where N is any integer greater than 0.

3. The biochip substrate of claim 1 where the mirror is a metallic film deposited upon a flat substrate.

4. The biochip substrate of claim 1 where the dielectric is silicon dioxide.

5. The biochip substrate of claim 1 where the dielectric is silicon monoxide.

6. The biochip substrate of claim 1 where the dielectric surface that is exposed is treated with amine to facilitate the attachment of chemical compounds.

7. The biochip substrate of claim 1 where the mirror is made of reflective

aluminum or silver.

8. A substrate for a biochip comprising:

a flat optical mirror surface which reflects incident excitation and/or emission photons,

a transparent dielectric layer coating said surface, and

a plurality of three-dimensional domains attached to the surface of said dielectric layer which yield detectable photon energy corresponding to the presence of analyte within a domain as a result of spontaneous emission, scattering or other mechanism,

said dielectric layer having properties such that, for a set or range of reference wavelengths, the dielectric thickness is such that net destructive interference occurs for at least one of the following conditions at the exposed surface of the dielectric opposite the mirror:

i. for incident excitation light energy destructive interference occurs between radiation propagating toward the mirror through the dielectric and reflected excitation radiation propagating away from the mirror, and

ii. for light energy emitted via spontaneous emission, scattering or other process, destructive interference occurs between wavefronts emitted or scattered toward the direction away from the mirror and wavefronts emitted or scattered toward the mirror and reflected by the mirror.

9. The biochip of claim 8 wherein the domains span a height such that detection of sources of optical emission or scattering occurs at an optical distance from the mirror where net constructive interference occurs for either or both of the following conditions, with respect to the set or range of reference wavelengths:

i. for incident excitation light energy, constructive interference occurs between radiation propagating toward the mirror through the dielectric and reflected excitation radiation propagating away from the mirror, and

ii. for light energy emitted via spontaneous emission, scattering or other process, constructive interference occurs between wavefronts emitted or scattered toward the direction away

from the mirror and wavefronts emitted or scattered toward the mirror that propagate through the dielectric and that are reflected by the mirror.

10. A system for analyzing a sample for the presence of specific targets, which system comprises:

a biochip that includes

a flat optical mirror surface which reflects incident excitation and/or emission photons,

one or more transparent dielectric layers coating said mirror surface, and

a plurality of three-dimensional domains attached to an exposed surface of said dielectric layer yielding detectable photon energy corresponding to the presence of analyte within the domain as a result of spontaneous emission, scattering or other mechanism, and

an optical detection system that is adapted to quantify the presence of analyte by measuring or imaging photons associated with each analyte domain,

said dielectric layer or layers having a thickness and refractive index such that, for a set or range of reference wavelengths, net destructive interference occurs for at least one of the following conditions at the exposed surface of the dielectric:

i. for incident excitation light energy destructive, interference occurs between radiation propagating toward the mirror through the dielectric and reflected excitation radiation propagating away from the mirror, and

ii. for light energy emitted via spontaneous emission, scattering or other process, destructive interference occurs between wavefronts emitted or scattered toward the direction away from the mirror and wavefronts emitted or scattered toward the mirror and reflected by the mirror.

11. The system of claim 10 where a source of excitation or illumination is used to induce optical emission from such analyte.

12. The system of claim 11 where for any sources of potential

background photon contamination at the plane of said exposed surface, net destructive interference occurs at the set or range of reference wavelengths providing a diminution of contaminant optical signal.

13. The system of claim 12 where an identifiable pattern of source brightness distribution can be imaged as determined by:

i. the three-dimensional morphology of the domains containing analyte, and
ii. the distribution of analyte within the three-dimensional structure of the domain.

14. The system of claim 13 wherein the quantity of domain analyte can approximated by a process that includes integrating the brightness over the entire image of the domain.

15. The system of claim 13 wherein an estimation of analyte quantity can be obtained from the brightness pattern by a process that includes integrating the brightness over the entire image of the domain, with greater weighting given to those regions with greater mean brightness.

16. A method of analysis using the system of claim 10 wherein a brightness pattern is first identified and such pattern is then used to estimate one or more of the following parameters:

i. morphological symmetry and regularity of the domain, including circular symmetry,
ii. conformance of the brightness pattern to an expected set of patterns, and
iii. physical dimensions of the domain based upon counting the number of bright or dark contours and using knowledge of the wavelengths within the dielectric and analyte domain.

17. The method of claim 16 wherein such conformance is measured relative to a scenario where analyte is uniformly distributed within the domain.

18. The method of claim 16 wherein such conformance is measured relative to a scenario where analyte is concentrated on the surface of the domain.